The Simulated Reality: Why Our Universe Looks Like Code

Dr. Simbashi Takamoto

Dr. Takamoto states from the start that he is not necessarily advocating for the principle of a simulated reality; rather, he is examining whether such a model, in principle, is compatible with what we know about physics, cosmology, and information. Historically, this model suggests that our understanding of the universe is moving from a model of continuity to a model of discreetness beginning many centuries ago when the ancient Greek philosophers Leucippus and Democritus proposed that all matter was made of discrete particles he they called atoms.

This trend continued during the age of reason when Isaac Newton showed that light did not gradually fade from one color to the next after passing through a prism, but instead, is laid down in discrete bands of colors leading to his belief that light must be "particle-like."

The advent of quantum theory in the 1900s furthered the idea of discreteness when the father of quantum theory, Max Planck used his mathematical formula E=hv to explain the dilemma of why a heated piece of metal does not radiate energy in a continuous manner as classical theory would predict but radiates energy in discrete amounts depending only on the frequency of light the metal absorbed, not its intensity.

Taking a cue from this discovery, Albert Einstein reasoned that if the energy emitted by a black body came in discreet amounts, then light itself must be made of particles, and building on Planck and Einstein's idea of packets of energy, Niels Bohr was able to explain why an electron did not gradually spiral into the nucleus of the atom, and why electron levels in an atom are allowed only in whole units of energy.

Takamoto states that more and more research suggests that spacetime itself is not continuous but discretely structured like the pixels of a screen or the frames of a video. The Planck length at about 10 to the -35 meters is considered to be the smallest meaningful distance, and Planck time of 10 to the minus 44 seconds is the shortest time interval that is meaningful in physics. Concerning the Planck length Takamoto states: "Measurement that tries to capture even finer details [of space and time] would require so much energy that it would create a black hole, thereby removing the region to be measured from observation."

We live in a physical universe whose laws can be described mathematically, which in turn, can be turned into digital programming code. If we understand that all information is physical—petroglyphs on a rock, words on paper, the electromagnetic arrangements of atoms on a CD, or the up-down spin of an electron—then it is not a stretch to say that the universe is made of information. This includes, according to physicist John Archibald Wheeler who coined the term,

"it from bit", all of physical reality including matter, energy, space, and time. Interestingly, considering information as physical, has implications for cosmology.

If information is physical, physicist Melvin Vopson reasons, then it must have a tiny bit of mass. This could explain the enigma of dark matter and dark energy which comprises about eighty percent of the observable universe but does not interact with electromagnetic energy making it invisible. The only way we know it is from its gravitational influence. This then, would make information a candidate for dark matter and dark energy, which has mass but is hidden until observed as quantum experiments have confirmed.

Takamoto says: "If the fundamental quantities of physics like charge, spin, or energy are nothing more than different states of an information system, then our entire universe could be the product of a cosmic quantum computer. In that case, the laws of nature would be nothing other than programming logic, and the constant speed of light or the Planck scales would be technical parameters like clock frequency or resolution in a computer system."

Takamoto says, "a programmed digital universe would not require a super intelligence." Nature uses simple rules applied again and again forming larger structures. This technique is used to construct processing units using Boolean logic building blocks in a combination of just three basic units of AND, OR, and NOT.

The beauty of this idea lies in the fact that the patterns emerge without a central plan; they are an emergent product of rules that are mathematical in nature such as we see in the recursive Fibonacci series of numbers (1,1,2,3,5,8,13,21,34,55) produced by adding any number in the series to the preceding number to get the following number in the series. Ancient people noticed that dividing any two adjacent numbers in the Fibonacci series, the former by the latter, will get one closer and closer to the sacred number Phi—the golden ration. (e.g. 34/55 yields .618…) This sequence of numbers is seen everywhere in nature, creating structures from the seeds of a sunflower plant to nautilus and snail shells, to hurricanes and galaxies. It seems that all life is merely a fractal of the universal code displayed in nature from giant sequoia trees to the information in the genome of every biological cell.

Nature's code can be seen in the DNA of every cell using the four-letter genetic code A, T, C, and G, first recognized by Francis Crick, to synthesize proteins and in cell replication. The process is very stable but occasionally errors occur. Thanks to redundancy and editing by various enzymes, the errors are corrected.

A similar error-correction system can be found in computer science called the Hamming code which can use pattern recognition to correct errors. James Gates, professor of physics and director of the Center for String Theory at the University of Maryland in College Park has found computer correction code writ into the fabric of the universe that is indistinguishable from the equations that drive search engines and browsers. Takamoto says, "No complex system would last long if it did not have ways to smooth distribution and repair defects. In a simulated reality,

it would be strictly necessary, because even the smallest numerical inaccuracies could have catastrophic consequences."

How did it happen that all the conditions necessary for emergence of life from the values of the four forces of nature to the mass of elementary particles to the conditions within stars are all tailor-made for the existence of life?

Three competing theories are: chance, design, and simulation. The hypothesis of chance is linked to the multiverse theory. Most physicists default to the "chance" idea because both design and simulation theories lead to infinite regress in that one wonders who or what was the orchestrator of the design in the first place; in addition, the concept of chance takes little intellectual effort and puts this conundrum to rest. The problem with the "chance" theory however is that there is no evidence for the multiverse hypothesis. Physicist John Wheeler says that the multiverse idea comes with too much baggage. But as we have seen, no designer or simulator need be present if the universe is just using the laws of nature as the parameters for recursive programs that learn over a period of 13.5 billion years that inevitably produced life.

So, where could this information be coming? Theorist Leonard Susskind working on black holes found that all the information inside a blackhole could be encoded two dimensionally on its event horizon. He later showed that this is a general principle of nature; the information contained in any volume of space is dependent upon its surface area—not its volume. This led Suskind to the hypothesis that reality could be a holographic projection from a thin layer of information surround our universe.

Dr. Takamoto states that he is not necessarily advocating for the simulation hypothesis, nevertheless, he has put me firmly into the simulation camp with this excellent work.